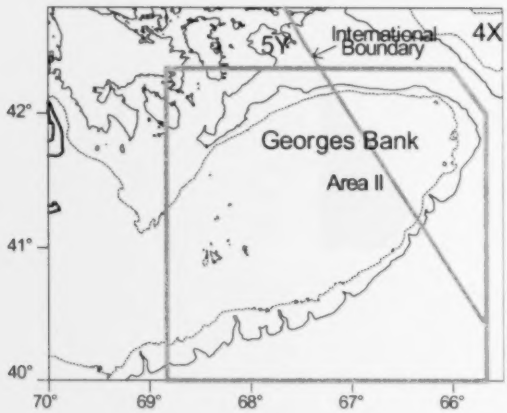
GEORGES BANK

YELLOWTAIL

FLOUNDER

[5Zhjmn; 522,525,551,552,561,562]



Summary

- Combined Canada and USA catches in 2008 were 1,275 mt.

- Adult biomass (Age 3+) increased from a low of 2,100 mt in 1995 to 11,000 mt in 2003, declined to 3,300 mt in 2006, and increased to 20,600 mt (Excluding the 2008/ 2009 DFO surveys) or 28,000 mt (Including the 2008/2009 DFO surveys) at the beginning of 2009, the highest adult biomass since 1973. Spawning stock biomass in 2008 was estimated to be 17,800 mt (Excluding the 2008/ 2009 DFO surveys) or 22,900 mt (Including the 2008/2009 DFO surveys).

- During 1998-2001 recruitment averaged 22.3 million fish at Age 1 but has since been below 20 million fish, with the exception of the above average 2005 year class estimated at 46.6 million, the strongest year class since the 1980 cohort.

- Fishing mortality for fully recruited ages 4+ was close to or above 1.0 between 1973 and 1995, fluctuated between 0.51 and 0.97 during 1996-2003, increased in 2004 to 1.85, and then declined to 0.09 (Excluding the 2008/2009 DFO surveys) or 0.08 (Including the 2008/2009 DFO surveys) in 2008, below the reference point of $F_{ref} = 0.25$.

- Assuming a catch in 2009 equal to the 2,100 mt total quota, a combined Canada/USA catch of about 5,000 mt (Excluding the 2008/2009 DFO surveys) or 7,000 mt (Including the 2008/2009 DFO surveys) in 2010 would result in a neutral risk (~50%) that the fishing mortality rate in 2010 will exceed F_{ref}. Fishing at F_{ref} in 2010 will generate a 3% increase in Age 3+ biomass from 21,400 mt in 2010 to 22,000 mt in 2011 (Excluding) or a 2% increase in Age 3+ biomass from 31,300 mt in 2010 to 31,700 mt in 2011 (Including).

Catches, Biomass (thousands mt); Recruits (millions)

		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Avg[1]	Min[1]	Max[1]
Canada	Quota	3.0	3.4	2.9	2.3	1.9	1.7	0.9	0.4	0.6	0.5			
	Landed	2.9	2.9	2.6	2.1	0.1	<0.1	<0.1	<0.1	<0.1		0.5	<0.1	2.9
	Discard	0.4	0.8	0.5	0.8	0.4	0.2	0.5	0.1	0.1		0.5	0.1	0.8
USA	Quota[2]					6.0	4.3	2.1	0.9	1.9	1.6			
	Catch[2]					5.9	3.8	1.9	1.0	1.6				
	Landed	3.4	3.6	2.5	3.2	5.8	3.2	1.2	1.1	0.7		4.6	0.4	15.9
	Discard	0.7	0.1	0.1	0.4	0.5	0.4	0.4	0.5	0.4		0.6	<0.1	3.0
Total	Quota[3]					7.9	6.0	3.0	1.3	2.5	2.1			
	Catch[3,4]					6.4	4.1	2.5	1.1	1.7				
	Catch	7.3	7.4	5.7	6.6	6.8	3.9	2.1	1.7	1.3		6.3	1.1	17.2
Excluding DFO 2008/2009 survey														
	Adult Biomass[5]	10.2	10.4	9.2	11.0	8.7	4.3	3.3	5.8	15.2	20.6	8.0[6]	2.0[6]	26.2[6]
	SSB	10.3	9.3	10.2	10.2	5.7	3.7	4.4	10.0	17.8		7.6	2.2	22.2
	Age 1 Recruits	19.8	22.3	15.4	11.3	8.9	19.6	46.6	20.1	2.8		22.4	2.8	70.6
	Fishing mortality[7]	0.96	0.97	0.65	0.60	1.85	1.25	1.06	0.41	0.09		1.02	0.09	1.85
	Exploitation Rate[7]	57%	57%	44%	41%	79%	66%	60%	31%	8%		59%	8%	79%
Including DFO 2008/2009 survey														
	Adult Biomass[5]	10.2	10.4	9.2	11.0	8.7	4.4	3.4	6.3	18.4	28.0	8.3[6]	2.0[6]	28.0[6]
	SSB	10.3	9.3	10.2	10.2	5.7	3.8	4.7	11.7	22.9		7.8	2.2	22.9
	Age 1 Recruits	19.8	22.3	15.4	11.4	9.2	21.3	58.1	35.6	9.5		23.4	6.6	70.6
	Fishing mortality[7]	0.96	0.97	0.65	0.60	1.84	1.23	1.01	0.38	0.08		1.01	0.08	1.84
	Exploitation Rate[7]	57%	57%	44%	41%	79%	66%	59%	29%	7%		59%	7%	79%

[1]1973 – 2008
[2]for fishing year May 1 – April 30
[3]for Canadian calendar year and USA fishing year May 1 – April 30
[4]sum of Canadian Landed, Canadian Discard, and USA Catch (includes discards)
[5]Jan-1 Age 3+
[6]1973 - 2009
[7]Age 4+ for calendar year

Fishery

Total catches of Georges Bank yellowtail flounder peaked at about 21,000 mt in both 1969 and 1970. Prior to the mid-1990s, the USA fishery accounted for most of the annual catches. The combined Canada/USA catch increased from 1995 through 2001, averaged 6,300 mt during 2002-2004, but declined to 1,275 mt in 2008 (Figure 1) due to restrictive management measures.

The 2008 **Canadian catch** of 158 mt was well below the Canadian quota of 550 mt, with landings of only 41 mt and estimated discards of 117 mt. Since there was no directed Canadian fishery for yellowtail in 2008, landings were incidental to cod and haddock fishing. Discards were due to the sea scallop dredge fishery.

USA catches in 2008 were 1,118 mt, with landings of 748 mt and discards of 370 mt. The USA landings in 2008 were predominantly from the trawl fishery while discards came from both the trawl and scallop dredge fisheries. Preliminary estimates of the USA catches for fishing year 2008-2009 were 83% of the 1,950 mt quota.

Ages 2-4 accounted for most of the **combined Canada/USA fishery** catch in 2008 by number, with few Age 1 fish caught due to mesh regulations. Both the Canadian and particularly the USA fisheries were well sampled to determine length composition of the catch.

Harvest Strategy and Reference Points

The Transboundary Management Guidance Committee has adopted a strategy to maintain a low to neutral risk of exceeding the fishing mortality limit reference, $F_{ref} = 0.25$. When stock conditions are poor, fishing mortality rates should be further reduced to promote rebuilding.

State of Resource

The state of the resource was based on survey observations and the range of results from plausible age structured analytical assessments (Virtual Population Analysis, VPA) that used fishery catch statistics and sampling for size and age composition of the catch for 1973 to 2008. The VPAs were calibrated to trends in abundance from three bottom trawl survey series (NMFS spring, NMFS fall and DFO) and a recruitment index from the NMFS summer sea scallop survey. Two VPA formulations were examined based on recommendations from the 2005 benchmark assessment review: 1) Base Case, the same formulation as used in the 2004 assessment, and 2) Major Change. Splitting each of the survey time series into two sets (i.e., 1973-1994 and 1995-2008) is the only difference between the Base Case and the Major Change VPAs. The Base Case formulation has not been used for management advice for the past few years due to a strong retrospective pattern and a lack of fit to recent indices. The Base Case formulation was examined this year and since it continues to show a strong retrospective pattern, it was not considered adequate for management advice, and only the Major Change formulation is presented here.

There is more uncertainty in this assessment than previous assessments due to the survey data. Specifically, the NMFS spring 2009 survey was conducted with a new vessel and net which does not have conversion coefficients available yet to allow its inclusion in the time series. Additionally, the 2008 and 2009 DFO surveys encountered individual tows that were much larger than any seen previously in the time series (7.5 mt in 2008 and 5.2 mt in 2009) and have a strong influence on the estimates for those years (Figure 2). The uncertainty associated with these values also approximately doubled. The preferred approach to deal with these indices would be to down-weight their importance in the VPA tuning by about half relative to other values in the time series. Two runs were considered as a means to bracket the preferred down-weighting approach: "Excluding", which does not include the DFO 2008 or 2009 indices in the fitting process, and "Including", which includes the indices with the same weight as all the other observations in the time series. Preliminary investigations confirmed that down-weighting the DFO survey indices gave results between the "Including" and "Excluding" runs.

Adult population biomass (Age 3+) increased from a low of 2,100 mt in 1995 to 11,000 mt in 2003, declined to about 3,300 mt in 2006, and increased to 20,600 mt (Excluding) or 28,000 mt (Including) at the beginning of 2009, the highest adult biomass since 1973 (Figure 3). Spawning stock biomass in 2008 was estimated to be 17,800 mt (80% Confidence Interval: 14,000-27,300 mt) for the "Excluding" run or 22,900 mt (80% Confidence Interval: 18,700-29,000 mt) for the "Including" run (Figure 4).

During 1998-2001 **recruitment** averaged 22.3 million fish at Age 1 but has since been below 20 million fish, with the exception of the above average 2005 year class estimated at 46.6 million (Excluding) or 58.1 million (Including), the strongest year class since the 1980 cohort (Figure 4). The 2006 year class is about average while the 2007 year class is estimated to be one of the lowest in the time series at 2.8 million (Excluding) or 9.5 million (Including), although this estimate is uncertain.

Fishing mortality for fully recruited ages 4+ was close to or above 1.0 between 1973 and 1995, fluctuated between 0.51 and 0.97 during 1996-2003, increased in 2004 to 1.85, and then declined to 0.41 (Excluding) or 0.38 (Including) in 2007 and 0.09 (Excluding) (80% Confidence Interval: 0.07-0.13) or 0.08 (Including) (80% Confidence Interval: 0.07-0.11) in 2008, below the reference point of $F_{ref} = 0.25$ (Figure 1).

Productivity

Age structure, spatial distribution, and fish growth reflect changes in the productive potential. In both absolute numbers and percent composition, the **population age structure** estimated by the VPA displays a truncated pattern with few old fish. **Spatial distribution patterns** in recent surveys are confounded by the influence of large tows. Truncated age structure in the bottom trawl surveys and changes in distribution indicate current resource productivity is lower than historical levels.

Outlook

This outlook is provided in terms of consequences with respect to the harvest reference points for alternative catch quotas in 2010. Uncertainty about current biomass generates uncertainty in forecast results, which is expressed here as the risk of exceeding $F_{ref} = 0.25$. The risk calculations assist in evaluating the consequences of alternative catch quotas by providing a general measure of the uncertainties. However, they are dependent on the data and model assumptions and do not include uncertainty due to variations in weight at age, partial recruitment to the fishery, natural mortality, systematic errors in data reporting or the possibility that the model may not reflect stock dynamics closely enough.

Due to changes in fishery partial recruitment patterns over time and increasing trends in both survey and fishery weights at age, average values from 2006-2008 were used in the projections. Assuming a catch in 2009 equal to the 2,100 mt total quota, a combined Canada/USA catch of about 5,000 mt (Excluding) or 7,000 mt (Including) in 2010 would result in a neutral risk (~50%) that the fishing mortality rate in 2010 will exceed F_{ref} (Figure 5). Fishing at F_{ref} in 2010 will generate a 3% increase in Age 3+ biomass from 21,400 mt in 2010 to 22,000 mt in 2011 (Excluding) or a 2% increase in Age 3+ biomass from 31,300 mt in 2010 to 31,700 mt in 2011 (Including). The 2005 year class is expected to account for 58-59% of the 2009 catch, 47-51% of the 2010 catch, and 40-44% of the 2010 Age 3+ biomass.

In the USA, there is a requirement to provide rebuilding projections when stocks are overfished. The rebuilding scenario for Georges Bank yellowtail flounder requires solving for a value of F (F_{reb75}) that, when applied in years 2010-2014, results in a 75% probability that SSB in 2014 is greater than SSB_{msy} (43,200 mt). Using the same starting conditions as the projection described above, the F_{reb75} was found through iterative search to be 0.02 (Excluding) or 0.085 (Including),

resulting in a median 2010 catch of 450 mt (Excluding) or 2,600 mt (Including), well below the F_{ref} projection described above. An alternative interpretation of the rebuilding requirements is to continue to project the F_{reb75} found last year according the method described above, which was 0.107. Fishing at F=0.107 in years 2010-2014 results in a median catch of 2,300 mt (Excluding) or 3,300 mt (Including) in 2010, but only a 52% (Excluding) or 69% (Including) probability of SSB_{2014} being greater than the rebuilding target of 43,200 mt.

Special Considerations

In the past, realized fishing mortality rates have been higher than the target F used to set the annual quotas. For example in 2005, a catch of 2,100 mt in 2006 was projected to produce a fishing mortality well below 0.25 using the Base Case model and 0.25 using the Major Change model. The realized 2006 fishing mortality was about 1 according to the current Major Change model. However, in more recent years the realized Fs are closer to the projected values. The 2007 TRAC Status Report used the Major Change model to project that a catch of 3,500 mt in 2008 would have a neutral risk of exceeding Fref=0.25. The observed 2008 catch of 1,275 mt is now estimated to have generated an F in 2008 of 0.09 (Excluding) or 0.08 (Including). The adult (Age 3+) biomass was projected to be 21,400 mt in 2008 and 24,900 mt in 2009, which are greater than the current estimates from the "Excluding" run of 15,200 mt in 2008 and 20,600 mt in 2009 but similar to the estimates from the "Including" run of 18,400 mt in 2008 and 28,000 mt in 2009.

Although the Major Change VPA is recommended for management decisions, the mechanisms for the large changes in survey catchability are not easily explained. These changes in survey catchability are most appropriately thought of as an aliasing of an unknown mechanism that produces a better fitting model. The inability to plausibly explain these survey catchability changes causes increased uncertainty in this assessment relative to other assessments. However, the Major Change VPA results more closely reflect the recent trend in abundance observed in all three surveys than the Base Case VPA, and the Major Change model is the preferred model from which to make management decisions. The Base Case model formulation will not be carried forward in 2010.

Source Documents

Legault, C.M., L. Alade, and K.J. Clark. 2009. Stock Assessment of Georges Bank Yellowtail Flounder for 2009. TRAC Reference Document 2009/03.

Legault, C., L. Alade, H. Stone, S. Gavaris, and C. Waters. 2008. Georges Bank Yellowtail Flounder. *In* Northeast Fisheries Science Center. 2008. Assessment of 19 Northeast Groundfish Stocks Through 2007: A Report of the 3rd Groundfish Assessment Review Meeting (GARM III), Northeast Fisheries Science Center, Woods Hole, Massachusetts, August 4-8, 2008. Northeast Fisheries Science Center Reference Document 08-15. [available at http://www.nefsc.noaa.gov/nefsc/publications/crd/crd0815/]

TRAC. 2005. S. Gavaris, R. O'Boyle, and W. Overholtz, editors. Proceedings of the Transboundary Resources Assessment Committee (TRAC): Benchmark Review of Stock Assessment Models for the Georges Bank Yellowtail Flounder Stock; 25 – 26 January 2005 and 26 – 29 April 2005. TRAC Proceedings 2005/01: 65p.

TRAC. 2009. L. O'Brien and T. Worcester, editors. 2009. Proceedings of the Transboundary Resources Assessment Committee (TRAC); 8-12 June 2009. TRAC Proceedings 2009/01.

Correct Citation

TRAC. 2009. Georges Bank Yellowtail Flounder. TRAC Status Report 2009/03.

Figure 1. Catches and fishing mortality. Note the two F lines are not distinguishable on this plot.)

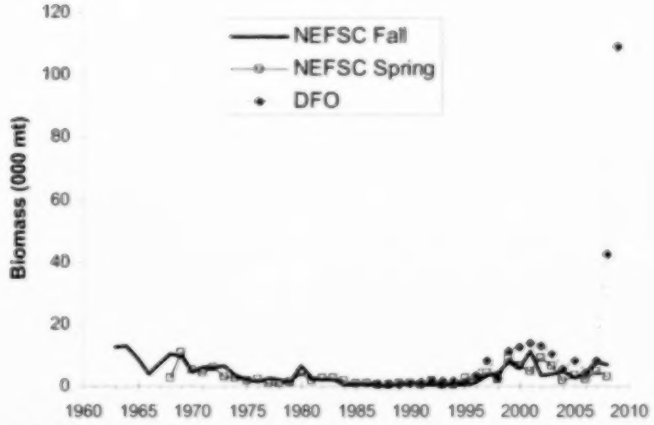


Figure 2. Survey biomass indices (minimum swept area).

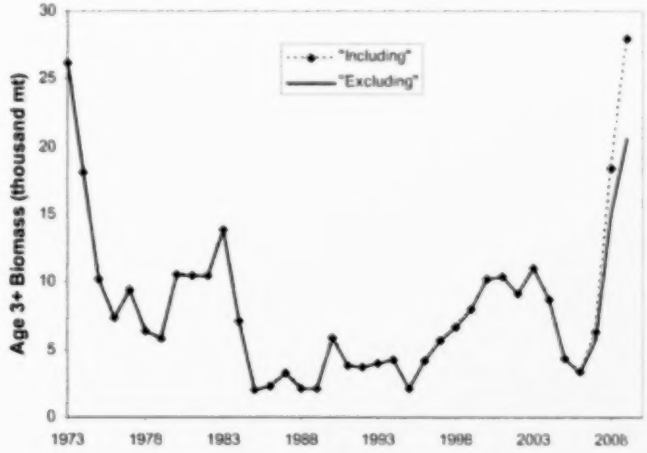


Figure 3. Ages 3+ biomasses.

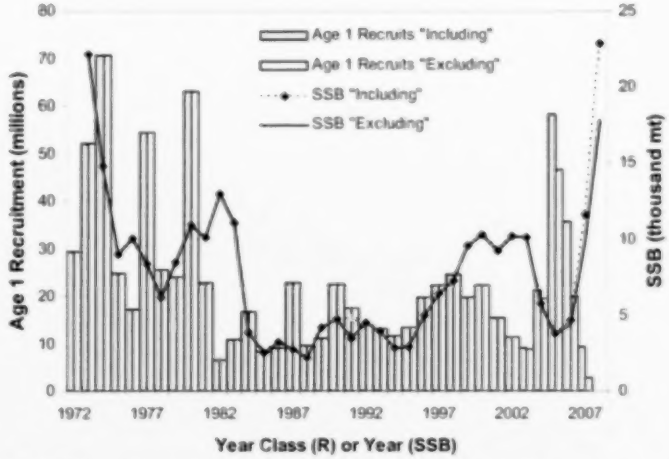


Figure 4. Recruitment and spawning stock biomass.

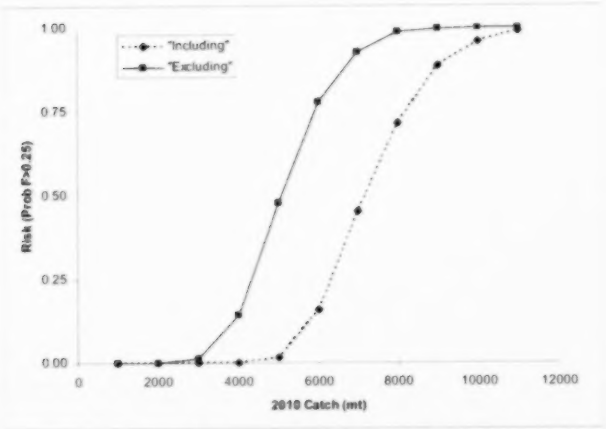


Figure 5. Risk of F exceeding F_{ref}=0.25 for a range of 2010 catch.